



COMPARATIVE STUDY OF FOETAL COLOUR DOPPLER VELOCIMETRY VERSUS NON-STRESS TEST AS A PREDICTOR OF PERINATAL OUTCOME IN HIGH-RISK PREGNANCY IN RIMS, IMPHAL: CROSS SECTIONAL STUDY

Obstetrics & Gynaecology

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ABSTRACT

Introduction: A high-risk pregnancy (HRP) is one that threatens the health or life of the mother or her foetus. Some pregnancies become high risk as they progress, while some women are at increased risk for complications even before they get pregnant for a variety of reasons. Risk factors for a HRP like gestational hypertension, diabetes mellitus, foetal growth restriction, post-dated pregnancy etc.¹ HRP increase the maternal and foetal morbidity and mortality and there is a need for appropriate investigation which can diagnose it early and predicts the morbidity and mortality. This study was undertaken to determine the etiology of HRP and the use of both NST and Doppler velocimetry for antepartum surveillance and compare the results in terms of perinatal outcome. **Aims And Objectives:** To determine the diagnostic accuracy of foetal colour doppler velocimetry versus non-stress test as a predictor of perinatal outcome in high-risk pregnancy. **Materials And Method:** A cross-sectional study was carried out in the department of Obstetrics & Gynaecology, Regional Institute of Medical Sciences, Imphal, Manipur w.e.f January 2021 – June 2022. The total of 114 high risk pregnant women >34wks POG were included in the study after applying inclusion and exclusion criteria. **Results:** In the present study, the diagnostic accuracy where only 13 (11.4%) out of 114 high risk pregnancies could detected by both Doppler and NST (True positive) and 58 (50.8%) is showing both non-reactive NST and normal Doppler study. The sensitivity of doppler to predict adverse perinatal outcome is more than NST but NST was found to be more specific in predicting caesarean delivery and poor birth weight. The overall proportion of poor foetal outcome in relation to diagnostic test where NST could detect 13 and foetal Doppler could detect 14 poor foetal outcome. It means foetal Doppler could detect slightly higher than NST (better diagnostic accuracy as predictor). **Conclusion:** A total of 114 HRP mothers (>34 weeks of pregnancy) were participated in the study where the mean age was 29.24±6.38 years. The present study demonstrated that Foetal Umbilical artery doppler is better predictor of foetal outcome in high risk pregnancies than non- stress test(NST) where it shows Mode of delivery (CS), oligohydramnios, NICU admission, low birth weight and poor APGAR score were higher in accuracy (sensitivity and specificity) to predict poor foetal outcome. Therefore, Foetal Colour doppler velocimetry is better predictor than Non-stress test (NST).

KEYWORDS

High-Risk pregnancies, Non-stress test, Foetal colour doppler velocimetry

INTRODUCTION

Antepartum foetal surveillance is of immense importance for detection of fetal compromise in utero in high risk pregnancies like gestational hypertension, diabetes mellitus, foetal growth restriction, post-dated pregnancy. Preeclampsia is a major cause of maternal and perinatal mortality and morbidity worldwide and responsible for 24 % of all maternal death in India.² In India about 20-30% pregnancies belong to high risk category, which is responsible for 75% of perinatal morbidity and mortality. Early detection and effective management of high risk pregnancy can contribute substantially in reduction of maternal and foetal adverse outcomes. Pradhan Mantri Surakshit Matruva Abhiyan is an initiative of Ministry of Health and Family Welfare Government of India to identify high risk pregnancies early and follow them so that they can be referred to health care centers with proper facilities so that women with high risk pregnancies may have healthy pregnancies and deliveries without complications.³

Christian Doppler 1st reported on the Doppler effect in 1842 describing the changes in the frequency of a light or sound wave produced by a changing between two objects.⁴ It is used to assess the

utero-placental circulation by studying uterine artery,⁵ feto-placental circulation by studying the umbilical artery, lastly foetal circulation by studying the foetal middle cerebral artery, ductus venosus etc.⁶

Doppler velocimetry of the Middle Cerebral Artery is the primary method of detecting foetal anaemia, with foetal anaemia the peak systolic velocity is enhanced due to greater cardiac output and decreased blood viscosity.⁷

The Non-stress test (NST) also is used to assess foetal well-being and employs the phenomenon of foetal heart rate acceleration in response to foetal movements.⁸ In fetuses at or beyond 32 weeks gestation, the accelerations is >15beats per minute above the baseline rate, and the acceleration lasts >15seconds. Before 32 weeks, accelerations are defined as having a rise >10 bpm above baseline for >10 seconds.⁹ A normal NST is termed reactive and requires two or more accelerations within 20 minutes of beginning the test.¹⁰ Before concluding that a test is non-reactive, a 40-minute or longer tracing should be performed. Although a normal number and amplitude of accelerations seems to reflect foetal well-being, their absence does not invariably predict

foetal compromise. Indeed, some investigators have reported false-positive rates>90%.¹¹

MATERIALS AND METHODS

Study Design: Cross sectional study.

Study Setting: Obstetrics & Gynaecology, Department, RIMS, Imphal.

Duration Of Study: January 2021 – June 2022.

Study Population: All high- risk pregnancy >34 weeks admitted in the Department of Obstetrics & Gynaecology

Sample Size: 114

Sampling Method: Convenient sampling method was followed

Inclusion Criteria:

- 1. Hypertensive disorder of pregnancy like gestational hypertension, preeclampsia, eclampsia
- 2. Oligohydramnios: AFI<5cm
- 3. Gestational DM
- 4. All cases of IUGR defined as foetal wt. < 10th percentile of predicted for GA
- 5. Decreased foetal movement
- 6. Anaemia
- 7. Post-dated pregnancy
- 8. Elderly primigravida
- 9. Heart disease

Exclusion Criteria

- 1. Mothers with foetus with congenital malformations
- 2. Mothers with IUD foetus
- 3. Patients with acute insults of placenta like abruptio placenta, scar dehiscence or cord prolapse

RESULTS:

Total 114 pregnant mothers were participated in the study.

Table 1: Age Category Of The Participants (N=114)

Age category	Frequency	Percent
<30 years	56	49.1
>30 years	58	50.9
Total	114	100.0

The mean age was 29.24±6.38 years ranges from 18 years to 42 years.

Age distribution was almost equal but > 30 years old slightly higher (51%).

Majority of the participants were POG of 37 to 40 weeks (70%). 96 out of 114 high risk pregnancies were educated up to matriculation (84.2%) followed by primary education (8.8%). In high risk pregnancies, majority were hypertensive (48.2%) followed by oligohydramnios (26.3%), GDM (15.7%), IUGR (16.6%) etc. Foetal Doppler findings shows that 40 out of 114 Foetal umbilical artery doppler study had abnormal (35.1%) and majority shows normal study (64.9%). Non-stress test shows that 29 out of 114 (25.4%) shows reactive NST and majority of the participants with non-reactive NST (74.6%). Mode of delivery shows that delivery outcome as mode of delivery where majority (75.4%) of the high-risk mothers underwent Cesarean delivery and a few had normal vaginal delivery (24.6%). Majority (81.6%) of the birth outcome as birth weight normal and 2.6% had a very low birth weight and birth weight 2-2.5 Kgs were 15.8%. Foetal outcome as APGAR score where the findings showing majority >7/10 score (89%) and only (11%) had poor APGAR score <7/10. Study shows that 32% of 114 high risk deliveries required NICU admission due to complications.

Table 2: Relationship Between Doppler Study And NST In High-risk Pregnancies (N=114)

Foetal Doppler	Non-Stress Test (NST)		P-Value
	Reactive	Non- reactive	
Abnormal	13(32.5%)	27(67.5%)	0.20
Normal	16(21.6%)	58(78.4%)	

The above table depicted that diagnostic accuracy where only 13 (11.4%) out of 114 high risk pregnancies could detected by both

Doppler and NST (True positive) and 58 (50.8%) is showing both non-reactive NST and normal Doppler study.

Table 3: Comparison Between Foetal Doppler And Non-stress Test In Foetal Outcome (N=114)

Predicting factors	Foetal Doppler (40) N (%)	P value	NST (29) N (%)	P value
Cesarean delivery	38 (95)	0.000	29 (100)	0.000
Meconium stained liquor	31 (77.5)	0.001	19 (65.5)	0.000
Low Birth weight	18 (45)	0.04	8 (27.5)	0.61
NICU Admission	23 (57.5)	0.004	14 (48.3)	0.000
Apgar score (<7/10)	9 (22.5)	0.002	4 (13.7)	0.20

As we can see the comparison between NST and foetal Doppler findings. CS delivery could be predicted by NST -100% than foetal Doppler -95%. But meconium stained amniotic fluid detection rate (77.5% vs 65.5%), LBW (45% vs 27.5%), NICU admission (57.5% vs 48.3%) and APGAR score <7/10 (22.5% vs 13.7%) were predicted by foetal Doppler study.

Table 4: Comparison Of Diagnostic Accuracy Of Foetal Doppler And Non-stress Test

Predicting factors	Non-stress test				Foetal Doppler			
	Sensitivity	Specificity	PPV	NPV	Sensitivity	Specificity	PPV	NPV
Mode of delivery (CS)	95%	35.1%	5%	64.9%	100%	32.9%	0%	67.1%
Amniotic fluid	60%	73%	40%	27%	93.1%	80%	6.9%	20%
Birth weight	25%	85.1%	75%	14.9%	27.6%	84.7%	72.4%	15.3%
Apgar score	10.2%	89.2%	90%	10.8%	27.6%	95.3%	72.4%	4.7%
NICU admission	32.5%	83.8%	67.5%	16.2%	48.3%	87.1%	51.7%	12.9%

As clear from above table that sensitivity of doppler to predict adverse perinatal outcome is more than NST but NST was found to be more specific in predicting caesarean delivery and poor birth weight

Table 5: Association Between Poor Foetal Outcome (Yes) And NST And Foetal Doppler

Diagnostic test	Poor foetal outcome - yes N(%)	P value
Non stress test – reactive	13 (48.1)	0.002
Foetal Doppler – abnormal	14 (51.9)	0.04

Above table depicted that overall proportion of poor foetal outcome in relation to diagnostic test where NST could detect 13 and foetal Doppler could detect 14 poor foetal outcome. It means foetal Doppler could detect slightly higher than NST (better diagnostic accuracy as predictor).

DISCUSSION:

This study was undertaken to determine the best screening protocol for pregnant women at a gestational age 34 week and onwards whose pregnancies were at increased risk for poor perinatal outcome. Color doppler changes indicate placental affection while non-stress test (NST) indicates the integrity of autonomic nervous system (ANS). Any hypoxic insult to ANS is reflected by a non-reactive NST. When both NST and color Doppler were abnormal it indicates that these foetuses suffer from severe placental insufficiency. Color doppler depicts chronic hypoxic changes while NST can detect acute events in presence or absent of chronic hypoxia. The present study demonstrated that foetal umbilical artery doppler is better predictor of foetal outcome in high risk pregnancies than non-stress test. Color velocimetry has higher accuracy in predicting mode of delivery (CS), oligohydramnios, NICU admission, low birth weight and poor APGAR score to predict poor foetal outcome in high risk pregnancies. But Non-stress test was better predictor of mode of delivery (CS) as specificity is higher than color doppler. A similar comparative study between NST and doppler waveforms was done by William KP et al¹² where the incidence of caesarean delivery for foetal distress was

significantly lower in the doppler study group compared with the non-stress testing group (30 vs 60).

In present study, Foetal Doppler shows better sensitivity in predicting poor APGAR score <7 (27.6% vs 10.2%), oligohydramnios (93.1% vs 60%), NICU admission requirements (48.3% vs 32.5%) and low birth weight (27.6% vs 25%) but NST shows better sensitivity in predicting birth outcome (85.1% vs 84.7%). Overall foetal doppler shows better accuracy. These findings are similar to study findings of Mehta N et al¹³ where it shows that patients with both NST and Doppler waveform abnormal (D) had the highest percentage of neonatal complication, NICU admissions and perinatal death. Those with NST normal but Doppler velocimetry abnormal (group B) had comparatively higher neonatal complications. However, in group with NST abnormal and Doppler velocimetry normal (group C) had no foetal compromise. Abnormal Doppler had statistically significant (p value =0.021) predictive value in detecting foetal compromise. The study findings by Srivastava M et al¹⁴ also favoured the present study findings as out of total 100 patients, Non-stress test was normal in 74 and was abnormal in 26, while Doppler was normal in 67 and was abnormal in 33 and sensitivity and specificity of doppler was 83.58% and 72.73% while that of non-stress test was 74.32% and 61.54% respectively.

Three out of 100 cases had absent end diastolic flow (AEDF) and all 3 were associated with perinatal morbidity with 2 perinatal deaths. Cerebroplacental ratio was < 1.08 in seven cases and all seven had neonatal complications including 3 neonatal deaths which also had AEDF. Thus, cerebroplacental ratio was better in detecting foetal compromise as compared to NST. One of the studies conducted at Imphal by Khwairakpam R et al¹⁵ also shown that the sensitivity of NST was only 25% compared to 71.42% by Doppler study whereas the specificity of the two modalities was comparable 93.75% and 88.13% respectively.

CONCLUSION

The main aim of this study was to determine the diagnostic accuracy of foetal colour doppler velocimetry versus non-stress test (NST) as a predictor of perinatal outcome in high-risk pregnancy. To conclude the study findings, total 114 pregnant mothers were participated in the study where the mean age was 29.24 ± 6.38 years ranges from 18 years to 42 years with normal distribution. Both primi and multigravida included in equally. Pregnant women from POG of 35 weeks to 42 were included and majority was 37 weeks to 40 weeks of gestation. In this present study, Foetal Colour Doppler shows 40 out of 114 abnormality and 26.4% (13 out of 114) reactive to NST. In the foetal outcome, majority delivery to high-risk mothers were by CS (75.4%), meconium-stained liquor was seen in 38.6% of the deliveries, 21 (18.4%) out of 114 had low birth weight, 11% had their babies APGAR score below score of 7 and 32% under went to NICU admission. 23.6% of high-risk pregnancies had both NST reactive and abnormal foetal doppler study and 14% of them were both NST non-reactive and normal doppler study. Both diagnostic tests are equally important to predict the foetal outcome but in the present study, overall poor foetal outcome could predicted better by Doppler velocity study than Non-stress test.

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